

## REMARKS

### A. Background

Claims 2, 3, 14-15, 22-24, and 31-36 have been amended. No claims have been cancelled. No claims have been added. Thus, claims 1-36 are pending in the present application. The specification and claim 22 have been amended to correct a typographical error and no new matter has been added. Support for the amendment to the specification and claim 22 can be found at paragraph [0034] of the application as filed. Support for the amendments to the remaining claims can be found, *inter alia*, at Figures 1 and 10A-10C and paragraphs [0034], [0046], and [0047] of the application as filed.

Favorable reconsideration of the application is respectfully requested in view of the above amendments to the claims and the following remarks. For the Examiner's convenience and reference, Applicant's remarks are presented in the order in which the corresponding issues were raised in the Office Action.

Please note that the following remarks are not intended to be an exhaustive enumeration of the distinctions between any cited references and the claimed invention. Rather, the distinctions identified and discussed below are presented solely by way of example to illustrate some of the differences between the claimed invention and the cited references. In addition, Applicant requests that the Examiner carefully review any references discussed below to ensure that Applicant's understanding and discussion of the references, if any, is consistent with the Examiner's understanding.

B. Consideration of Previously Submitted IDS

Initially, Applicant notes that an Information Disclosure Statement was filed by the Applicant in the present application on September 28, 2004. The present Office Action, therefore, fails to acknowledge receipt of the IDS. Applicant respectfully requests acknowledgement of receipt of the IDS and an initialed copy of the corresponding Form PTO-1449 returned.

Additionally, enclosed please find a supplemental Form PTO-1449 submitted with a supplemental IDS. Applicant respectfully requests that the Examiner acknowledge receipt and consideration of the references by initialing and returning a copy of the supplemental Form PTO-1449. The Examiner is respectfully requested to contact the Applicant if an additional copy of the references is required.

C. Rejection on the Merits

1. Rejections Under 35 U.S.C. § 112

Claims 2, 4-6, 14, 15, 23, 25-28, and 31-34 have been rejected under 35 U.S.C. § 112 as being indefinite and for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Particularly, claim 2 and 23 have been rejected for not reciting a structurally cooperative relationship for the collector region or the cold heat exchange surface with respect to the layers and regions in the respective parent claims. In response, Applicant has amended claims 2 and 23 to recite, "further comprising a collector region in thermal communication with a cold heat exchange surface, the collector region being in electrical and thermal communication with the

gap region. Accordingly, the prompt removal of this rejection of claims 2 and 23 (as well as claims 4-6, 14, and 25-28, which depend from claim 2 or claim 23) is respectfully requested.

Claims 14 and 15 have been rejected because the term “the cold side” lacks antecedent basis in the parent claim. Claims 14 and 15 have therefore been amended as suggested by the Examiner to remove the need for antecedent basis.

Claims 31-34 have been rejected as indefinite because none of  $n^*$ ,  $p$ ,  $n$ ,  $p_i$  and  $p_c$  have been defined in the claims. In response claims 31-34 have been amended to explicitly define  $n^*$ ,  $p$ ,  $n$ ,  $p_i$ , and  $p_c$  in the context of these claims. Accordingly, Applicant respectfully requests the prompt removal of the rejection of claims 31-34 under 35 U.S.C. § 112.

2. Rejections Under 35 U.S.C. § 102 and Alternatively Under 35 U.S.C. § 103

Claims 1-6, 8-10, 17-27, 29-33, 35 and 36 have been rejected under 35 U.S.C. § 102(b) as being anticipated by or in the alternative, under 35 U.S.C. § 103(a) as obvious over JP 2001-217469 (“JP ‘469”). Applicants respectfully traverse.

Before discussing the anticipatory rejections herein, it is thought proper to briefly state what is required to sustain such as rejection. As the Examiner is aware, the issue under § 102 is whether the PTO has provided a single prior art reference that expressly or inherently describes each and every element set forth in the rejected claim. Verdegaal Bros v. Union Oil Co. of California, 814 F.2d 628, 631 (Fed. Cir. 1987). Accordingly, if the reference does not describe each and every element, the reference cannot anticipate the claim. The Applicants respectfully assert the PTO has not satisfied the requirement for establishing that any of the rejected claims has been anticipated by the prior art.

Similarly, the PTO must satisfy certain requirements in order to establish an obviousness-type rejection. The issue under § 103 is whether the PTO has stated a case of *prima facie* obviousness. According to the MPEP § 2142, the Examiner has the burden and must establish a case of *prima facie* obviousness by showing some motivation in a prior art reference to combine that reference with other prior art, or modify that reference, to teach all of the claim limitations in the instant application. The Applicant respectfully asserts the Office Action has not satisfied the requirement for establishing a case of *prima facie* obviousness.

With reference to the present rejections, each of the present independent claims recite, among other things, a barrier layer that is “configured to provide a potential barrier and *Fermi-level discontinuity*.” (emphasis added). Initially, the Applicant respectfully disagrees with the Office Action’s characterization of the inherency of Fermi-level discontinuities when a barrier layer is positioned between an emitter region and a gap region. Rather, in order to have a Fermi-level discontinuity, the barrier layer must be “formed to create a potential barrier for hot electron injection, and provide[] a discontinuity of the Fermi levels” (paragraph [0047]). Also, the “addition of any *p*-type layer on an *n*-type gap creates a potential barrier, but only high enough concentration of *p*-type carriers ensures a discontinuity of the Fermi-level” (paragraph [0047]). Additionally, “positioning of the Fermi level relative to the bottom of the conduction band as a function of donor and acceptor concentration is described by Kane’s diagram” (paragraph [0047]). As a result, the presently recited barrier layer is different from that of just any alternating layered materials (e.g., *n/p/n* or *p/n/p*).

*JP’469* has no such teaching of Fermi-level discontinuities. *JP’469* discloses a thermoelectric element having a *p*-type semiconductor material and an *n*-type semiconductor material (paragraph [0001]). The thermoelectric element is configured to have alternating *n*-type

semiconductor and p-type semiconductor materials in a p/n/p/n/p arrangement (paragraph [0017]). Additionally, the thermoelectric element can be prepared by sintering after compression molding, or other compression molding techniques (paragraph [0016]). This manufacturing process for creating the alternating n-type and p-type arrangement was taught to result in a thermoelectric element for generating power when a higher temperature is applied to one end compared to the other end (paragraph [0061]). However, *JP'469* is completely devoid of teaching anything related (explicitly or implicitly) to barrier layers providing Fermi-level discontinuities between emitter regions and gap regions. More particularly, *JP'469* never teaches or suggests variations in carrier doping concentrations in order to achieve a Fermi-level discontinuity.

As such, the Applicant respectfully asserts that present independent claims 1, 17, 22, and 31-36 are distinguishable over the prior art because Fermi-level discontinuities are not inherently present in the *JP'469* reference, the Fermi-level discontinuities are not explicitly taught, and/or the Fermi-level discontinuities are not even suggested. In addition, dependent claims 2-6, 8-10, 18-27, 29, and 30 depend from one of the independent claims, contain the limitations therein, and are therefore patentable over the cited reference for at least the same reasons as the independent claims. As such, Applicant respectfully requests the withdrawal of the rejection of claims 1-6, 8-10, 17-27, 29-33, 35 and 36 under 35 U.S.C. § 102 and 103.

With specific reference to claim 17, the Office Action did not provide any reason that *JP'469* anticipated or made obvious claim 17. Claim 17 claims a solid state energy converter with n-type conductivity with a segmented gap region “comprising a first layer of a semiconductor material, and a second layer of a metal or different highly *n*-doped semiconductor material, the second layer reducing heat flow density.” A detailed reading of *JP'469* shows that

such a segmented gap region is not disclosed or suggested. More particularly, *JP '469* does not teach or suggest that such a segmented gap region adjacent to a barrier *p*-type region would be beneficial in a thermoelectric energy converter.

Since *JP '469* does not disclose or suggest each and every element in present claim 17, *JP '469* cannot anticipate or obviate claim 17. Claims 18-21 depend from claim 17 and are therefore patentable over *JP '469* for at least the same reasons as claim 17. As such, Applicant respectfully requests the withdrawal of the rejection of claims 17-21 under 35 U.S.C. § 102 and 103.

2. Rejections Under 35 U.S.C. § 103

Claims 7 and 28 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *JP '469*. In response, the Applicant respectfully asserts that claims 7 and 28 are not obvious over the prior art for at least the reasons set forth above with respect to claims 1 and 22, from which claims 7 and 28 depend. Accordingly, Applicant respectfully requests the withdrawal of this rejection and the prompt allowance of claims 7 and 28.

D. Allowable Subject Matter

Applicant respectfully thanks the Examiner for the indication that dependent claims 11, 12, 13 and 16 contain allowable subject matter and would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claim. For the reasons noted above, however, the Applicant believes the base independent claims are allowable over the prior art. As such, claims 11, 12, 13 and 16 have not been rewritten in

independent form at this time. The Applicant therefore respectfully requests reconsideration and allowance of these claims in their current form.

#### CONCLUSION

In view of the foregoing, Applicants respectfully request favorable reconsideration and allowance of all the presently pending claims. In the event the Examiner finds any remaining impediment to the prompt allowance of this application, which could be clarified by a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney.

Dated this 26th day of January 2005.

Respectfully submitted,

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